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ABSTRACT

Three major types of technology being used as part of the curriculum in preschools serving children with varied abilities and needs are discussed, namely television, videos/interactive videodisc, and computers/software. The discussion covers how the technology is used, its impact on developmental domains, and suggestions for improved development and use of technology with very young children. First, technology and assistive technology are defined. Early concerns regarding the use of technology with young children are addressed, such as the quantity of television watched and the value of computers. Current research findings regarding the developmental impact of television, video technology, and computers and oftware are summarized. Effects of the use of instructional computer technology on written language, mathematics, and social/emotional development are specified. Factors affecting successful technology integration into the curriculum are specified. Assistive adaptations of technology for young children with disabilities are also considered for television, video, and computers. Finally, a set of recommendations addresses: technology transfer, technology integration, appropriate choices, needed areas of development, adult mediation and scaffolding, and continuing education and support for parents and teachers. Specific resources in assistive technology, emergent literacy, software, sources of books on computers, sources of independent software reviews, a software list, and a courseware definition form are attached. (Contains 100 references.) (DB)

Technology Integration into Early Childhood Curricula: Where We've Been, Where We Are, Where We Should Go

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All 12 three year olds in Miss Duncan's class are excited because tomorrow is Jamie's fourth birthday and they've got work to do. Sarah, Jonathan, and Amy are making cupcakes. Sarah tells the other two children what ingredients to add to the cake mix by pressing the appropriate pictures and words on her augmentative communication device. Amy gets the cake mix, the water, and the egg and puts them in a bowl as directed by Sarah. Then Jonathan hits his adaptive switch with his chin to turn on the mixer to stir every thing together.

Over at the computer, Fran and Juan are making a banner that says, "Happy Birthday to Jamie." Miss Duncan helped them to spell the words and now they are making it beautiful by choosing the pictures they want from Big Book Maker (Queue) on the computer monitor screen. When Fran and Juan, who is just beginning to learn English, touch the TouchWindow (Edmark), the computer speaks their choice and any other words or letters they have typed in. Later on in the afternoon, Meg and Tim make a birthday card for Jamie at the computer using Bailey's Book House (). Meg, who's already 4, types "haby brda" and her name on the keyboard. Tim chooses the illustration for the card by hitting his switch, connected to the Macintosh LC II with a Ke:nx (Don Johnston) to scan through the choices.

The other children look at boxes containing videotapes and audio cassettes to decide what they would like to show during the party. Joe sings "Happy Birthday to Jamie" into a tape player so that Jonathan and Tim can hit their switches to activate the tape player and can sing to Jamie tomorrow, too.

This preschool classroom may seem futuristic but is in fact a compilation of scenes observed in actual preschool classrooms during the 1993-1994 school year (Koppenhaver, Pierce, Johnson, Stuart, & Yoder, 1994; Koppenhaver, Staples, Erickson, & Yoder, 1994). What is different about this classroom description and many other settings serving preschool children today from five to ten years ago is that children from many different backgrounds with varied and unique abilities and needs are being taught together. Inclusion of preschool children with disabilities into settings where typically developing children are educated is a universally accepted social policy and is required by public legislation such as the Individuals with Disabilities Education Act (IDEA) (Buysse & Bailey, 1993). Another major difference in the preschool classroom of today and those of a decade ago is the integration of technology such as televisions, computers, and video players into the curriculum. Projections are that nearly all licensed preschools will have access to daily computer use by then end of the 1990's (Goodwin, Goodwin, & Garel, 1986). Preschool children watch on the average of 25-35 hours per week of television, more TV viewing than any other age group (Clements, 1985b; Singer & Singer, 1981).

The use of assistive technology such as the adaptive switches, the special computer interface, and the augmentative communication device described above is also mandated by the IDEA and has made it possible for preschool children with disabilities to be more successful and participatory in included preschool settings (Beukleman & Mirenda, 1992; McCormick, 1987).

The use of technology with all young children can be a powerful tool which can facilitate cognitive, social, communication, and motor development (Buckleitner, 1994). This chapter will discuss three major types of technology: television, videos/interactive videodisc, computers and software, currently found being used more often as a part of the curricula for young children, ages birth through five years. This discussion includes how technology is used, its impact on developmental domains, and suggestions for improved development and use of technology with very young children. Assistive technology options and strategies for technology use with young children with disabilities will also be described.

What is Technology?

We live in a "techno-society." Every facet of our modern lives is assisted by use of some form of technology. We are awakened by a digital alarm clock that either plays music, speaks the time, or in some cases a message such as, "time to get up, sleepy head." Hopefully, our pre-programmed coffee maker has activated and is brewing while we use hair dyers, electric shavers, electric hair curlers. Our society has become dependent upon gadgets, technology, to work, learn, play, and live.

Technology is supposed to help us to do things better and quicker, or at least help us to enjoy our lives to a greater extent. The term, technology includes both a product, a tool, as well as the process of using the tool (Peck & Dorricott, 1994). Technological tools and their use to facilitate cognitive skill development was introduced with children as soon as technology itself became readily available. The High/Scope Curriculum Demonstration Project Study (Schweinhart, Weikert, & Larner, 1986) first began assessing the effects of

using computers with young children in 1978 and continues to update the literature on its findings and suggestions of software integration into early childhood curricula (Buckleitner, 1994; Buckleitner & Hohmann, 1987). Computer use in early childhood education became proliferate in the early 1980's to develop creative thinking and problem solving skills (Anselmo & Zinck, 1987). Other types of techno'ogy which have been successfully used in the education of elementary, middle, and h gh school students include calculators, two-way audio and video, telecommunications, and laser videodiscs (Hancock & Betts, 1994).

Assistive technology, the term applied to types of technology used with person with disabilities, had been discussed in educational and clinical literature since the early 1970's. Assistive technology has been coined the "freedom machines" (US Congress, OTA, 1988) that compensate for cognitive, sensory, motor, and communicative limitations. Assistive technology includes adaptations of generic devices (e.g., calculators that talk or have large numerals on the keypad); specialized equipment used with generic devices (e.g., an adaptive keyboard interfaced with a computer); and, dedicated devices that do what generic technology cannot do (e.g., portable augmentative communication devices, hearing aids) (Lewis, 1993).

Technology, then, currently refers to mechanized tools used to accomplish a task better, easier, faster, and/or more independently and includes anything from a can opener to a car. Any person of any age or ability uses some type of technology on a daily basis to accomplish a variety of tasks.

Early Concerns Regarding Use of Technology with Young Children

Clements and Nastasi (1993) discuss the trends that research on innovations usually follows. Reports in the literature usually begin with concerns about the innovation, "Will it be harmful? Will it replace what we already use or do?" These concerns usually turn out to be unwarranted so researchers then tend to begin looking at more specific use of the innovation: How, When, Where, and Why to use a new approach or material, and

specific content of the innovative strategy, material, or technology. Questions turn from "Do we use or do this?" to, "How do we do or use this?" and always, "What are the effects of using or doing something new?"

Descriptions of using technology with young children follow these research trends. Allowing or even suggesting that young children watch television or videos while at school or use computers at all was a question of tremendous concern and initial views were not as positive as those found in the current body of literature. Research during the 1980's was myopic in nature, looking at specific concerns and areas of skill impact that use of technology might and did have. Current research regarding technology use is more ecological in nature. How technology can be most successfully used, and what the human factors are in the success use of technology in the classroom is the focus of studies in the 1990's (Clements & Nastasi, 1993; Dwyer, 1994).

One area of concern in the use of technology that has been and continues to be studied, is the amount and content of television programming seen by young children. Children under the age of 18 months are on the average already viewing television for approximately 1.5 hours per day (Clements, 1985b; Singer & Singer, 1981). Children as old as 8-9 years do not understand the intent of commercials and are too trusting and vulnerable to the intent television advertising (Feshbach, Feshbach, & Cohen, 1982; Watkins et al, 1988). Even though television viewing was initially thought to be linked to hyper activity and attention deficits, opposites effects have been shown. Properly produced educational programming (slow-paced, structured) does not produce hyperactivity and increases attention and comprehension of program content (Clements & Nastasi, 1993). Effect of television programming not appropriately designed for young viewers will be described in a later section.

In the early 1980's many educators of young children were familiar with home personal computers but had difficulty generalizing the use of computers into their classroom curricula. Even though early researchers claimed benefits in using computers

with young children (Papert, 1980; Turkle, 1984), most practitioners were hesitant to replace, augment, or even generalize from traditional preschool materials like blocks, sandboxes, and water tables to computers (Anselmo & Zinck, 1987). Their basic questions was, "What can computers do that we aren't doing already?"

In addition to concerns regarding the value of using computers, early childhood educators were actually concerned about the harm using these "cold machines" might have on the social and emotional development of young children (Clements & Nastasi, 1993). Practitioners and researchers alike propositioned that children might not develop peer relationships or adult-child interactions if they spent large amounts of time using a computer. An overall concern for mechanized (computer) replacement of hands-on activities such as coloring with crayons, stacking blocks, or playing in a sandbox is mentioned in much of the early literature describing computers and preschoolers (Anselmo & Zinck, 1987; Clements, 1985a; Cuffaro, 1984; Tan, 1985). As late as 1990, teachers expressed concern that children in Head Start were "so far behind that they needed to concentrate on the basics, not using computers" (Hutinger, Robinson, & Johanson, 1990, p.32).

A mirror of these concerns was reflected by practitioners and researchers working with young children with disabilities. Use of augmentative communication devices for children not developing speech was viewed as a failure on the part of both the child and clinician (Attermeier, 1987) and was thought to interfere with speech development (Shane, 1992). Parents and professionals alike were concerned that using a computer and other assistive technologies might hamper communication and motor development (). Pre-requisites to using assistive technologies were developed to ensure that adequate trials of traditional methods had been given and to make sure that the child was ready to use a piece of technology (Shane & Bashir, 1980). These notions of technology use with children with disabilities were held during the first several decades of use and are still found in some part of the country even today:

- Exclusive use of assistive technology as opposed to traditional teaching strategies and speech or other motor skills;
- Assistive technology interferes with rather than enhances learning and function; and,
- Certain perquisite skills must be demonstrated by young children before assistive technology can be offered as an option to a child with a sever cognitive, communicative, motoric, and/or sensory impairment ,

These ideas became obsolete by the mid to late 1980's (Romski & Sevcik, 1988).

The disabilities field seemed to move quickly through the trends of research and practice concerns because by the mid-1980's use of assistive technology such augmentative communication devices with non-speaking children had become the expected approach to help foster communication skills (ASHA, 1991) . Computer use was also widespread to help children with disabilities to calculate and communicate in written and spoken modes.

In general, researchers, practitioners, and parents working with young children with and without disabilities expressed initial concern over using technology with children because they feared it would:

- replace existing "tried and true" materials and strategies;
- interfere with normal development; and,
- not be available or accessible to all children and therefore place disadvantaged children at an even greater disadvantage.

Current Technology Use and Developmental Impact

Initial researcher and practitioner concerns regarding using technology with preschoolers were on the whole un-founded. Overall, using computers, video, and television technology as an integrated part of a preschool curriculum fosters many areas of skill and ability in young children both typically developing and those with disabilities. The positive effects of using computers and television on child educational outcomes has been well substantiated (Clements & Nastasi, 1993). Technology options have not

replaced traditional preschool offerings, children seemed to continue to choose more movement-oriented activities (e.g., blocks, cars and trucks) over watching television using a computers (Anselmo & Zinck, 1987; and Hoover & Austin, 1986). Technology can be successfully integrated into preschool settings without decreasing engagement with more traditional preschool activities, with positive outcomes on child development (Clements & Nastasi, 1993). The following section describes the developmental impact the use of technology with young children as reported in the literature.

Television. The key to beneficial television viewing by young children is the quality of programs they watch and the amount of time spent watching television as opposed to being engaged in other activities. Educational television programming (e.g., "Sesame Street") has been found to develop specific skills such as alphabet and number naming (Ball & Bogatz, 1973). Piagetian concepts such as number conservation and seriation have also been taught through televised modeling of these constructs (Raeissi & Wright, 1983). Televised stories were preferred and fostered greater understanding, especially with teacher mediation in combination with the audio and video presentation (Choat & Griffen, 1986). Television viewing may help build background experience which aides in reading comprehension in young children form lower SES environments (Reinking & Wu, 1990).

The amount of time watching television can have deleterious effects. Television viewing amount is negatively correlated with oral and written language development (Clements, 1985; Nelson, 1973; Singer & Singer, 1993). Reading achievement is more negatively affected by significant amounts of television viewing (10-20 hours/week) in older children in intermediate grades, but moderate amounts of television viewing does not seem to negatively affect younger children in beginning stages of word recognition and decoding (Reinking & Wu, 1990). Children with higher IQs may be the most adversely affected group by higher viewing times (Williams, Haertel, Haertel, & Wallberg, 1982).

Type of television programming that young children view may also be linked to unwanted behaviors. Watching violent television shows has been unequivocally linked to increased violent, aggressive behavior in young children (Huesman & Malamuth, 1986). There is a growing body of evidence that supports a connection between television viewing, aggressive behavior, and poor achievement (Clements & Nastasi, 1993). The link is not known to be causal, but a combination of the following television viewing-related factors appears to put a child at risk for behavior problems:

- unlimited television viewing (no control for type of programming watched or amount of time of television viewing), especially during the preschool years;
- limited availability of other forms of entertainment (e.g., books, music);
- inability to distinguish television from reality;
- limited adult mediation regarding television programming (Huesmann, 1986).

To realize the effect that television programming has on child behavior, prosocial behavior has been increased in children who watch programs depicting positive racial relationships (Eron, 1986). Prosocial programming has also been shown to increase creativity and imagination (Singer & Singer, 1986). In general, television appears to offer influential role models for young children, especially when no other alternative are available (Clements & Nastasi, 1993). Through appropriate instructional television, children can view and discuss positive auditory and visual information they might otherwise not experience (Peck & Doricott, 1994).

Video Technology. Children as young as 3 years of age can independently operate a VCR (Linlof & Shatzer, 1990) and in most American homes where there is a television, there is also a VCR and a large collection of videotapes (Krendl, Clark, Dawon, & Troiano, 1993). Preschoolers report that they are permitted to independently choose and play tapes (Krendl, et.al., 1993). Videotaped movies or other programming may have the stop and start advantage but similar effects and caution must be given to this medium and has been described above regarding television programming. Even video games which

portray violent acts may foster aggressive behavior (Silvern & Williamson, 1987). Preschool children do not differentiate among videos, television programming, or taped television. To them, a television is a delivery system for all of these forms of media (Krendl, 1993).

Parents have reported that they engage in more prescreening activities and more monitoring of their children's viewing since the introduction VCR's into their homes. Their children the other hand do not report these changes but do indicate that their parents withhold video viewing for punishment and grant viewing for rewards (Kim, Baran, & Massey, 1988). Parental, primarily maternal, rules for video viewing, both content and time quantity, do exist, but are often confusing to preschool children, or at least enforced arbitrarily, i.e., children tend to be allowed to watch whatever they wish when their parents are busy (Krendl, et.al., 1993).

There is a plethora of instructional videos available today geared towards a variety of learners and subjects. Videos to teach 5-6 year olds self-protection were found to be superior in outcome to standard approaches (Poache, Yoder, & Miltenberger, 1988). Videodiscs put thousands of images and information at a child's finger tips and can transport a child to any environment for learning and discussion (Peck & Dorricott, 1994). Videodiscs are a relatively new addition to educational technology. Only about 21% of the nation's K-12 school districts have videodisc players available for teachers to use (Looms, 1993). Analysis of videodisc use has been done with older elementary and middle level students in content areas such as science. Findings are similar to uses of other types of technology, i.e., students make more significant gains in both the subject area as well as in ancillary areas such as self-esteem and a positive attitude toward learning when using this type of technology (Rock & Cummings, 1994).

New technology driven art forms include use of video production, digital photography, and computer-based animation. These techniques are highly motivating to students and encourage artistic expression (Peck & Doricott, 1994). These technologies

have been used in a Head Start program for families to develop and present videotapes about themselves to other families (Koppenhaver, Staples, et. al., 1994).

Computers and Software. Personnel working with the High/Scope Project found that a computer used with young children to be "a powerful learning device that facilitates cognitive development and positive social interaction without harm to young children" (Buckleitner & Hohmann, 1987, p. 338). In addition to developing the specific skills targeted in intervention studies such as comprehension, memory, and other "thinking skills" (Anselmo & Zinck, 1987) ancillary abilities were developed. Papert (1980) and Buckleitner & Hohman (1987) found that computer use helped children to move from concrete to symbolic representational thought. Anselmo & Zinck (1987) found that children developed early written and oral language abilities while using software chosen to develop memory and creative thinking. Hutinger, Robinson, & Johanson (1990) observed an increase in parental, especially paternal, interest and involvement in their Head Start program with the advent of computer use. A decade ago Walker (1983) found several positive aspects of computer use in the education of young children which included more active, independent learning with varied sensory and conceptual experiences. Today computers continue to foster a positive attitude towards learning (Clements & Nastasi, 1993).

In 1986, Apple Computers donated two computers to seven classrooms that represented a cross section of American K-12 students. One of the computers was for classroom use, and the other for the teacher to use at home. These Apple Classrooms of Tomorrow (ACOT) were also given technical support from local universities. In the eight years of studying the outcomes in these sites, significant educational, motivational, and social gains were documented. There appeared to a significant programmatic shift as well in these classrooms where technology was as an integral a part in instruction as were the students, the teachers, and traditional educational media. Dwyer (1994) describes this programmatic shift as going from "instruction to construction" as follows:

1. Classroom activities moved from very teacher centered, didactic presentations to more interactive learner-centered lessons.

2. Teacher's roles transformed from expert to collaborator.

3. Student's role also became more collaborative in developing and implementing learning activities.

4. Instruction emphasis moved from fact memorization to problem solving and analysis skill development.

5. Progress was evaluated more by quality rather than quantity of output and criterion-referenced and portfolio assessments became the standard practice of assessment.

6. Computers were used less for drill and practice activities and more for communication (e.g., information access and expression) over the eight years of use in the Apple classrooms.

Computer use impacts on practically every skill from each developmental domain from eye-hand coordination (Ziajka, 1983) to speaking French (Cohen, 1993) has been discussed in the extant literature. Major areas of impact of computer use discussed in the literature include cognition, language, mathematics, and social/emotional development and are briefly reviewed below.

Cognition. Chin (1984) and as mentioned previously, Anselmo and Zinck (1987) increased cognitive abilities such as memory, spatial and logical problem solving in preschool children by using computers and software available at that time (e.g., Apple LOGO™, 1983; Ernie's Quiz, 1981). Cohen (1993) reported gains in preschool children's self-learning, self-organization, memory, and concentration through using a computer with speech synthesis.

Oral Language. Oral language production, as measured as number of spoken words per minute, is almost twice as high at the computer than during other activities such as block play (Muhlstein & Croft, 1986), and is especially high for preschool children with disabilities (McCormick, 1987). Cohen (1993) used computers and a software package

that presented written then spoken words to teach French to 3 & 4 year olds. She reports development of spoken language via use of a speech synthesizer and computer because the computer became a new "playmate, a voice" which was very motivating and encouraged commenting and discussion among the children (p. 27). Anselmo and Zinck (1987) in their computer use study found that children often taught one another how to use menu items and prompts on new pieces of software as they figured out different abilities of new pieces of software.

Written Language. As soon as computer technology became accessible to preschool programs, it was used to develop literacy skills. Perhaps this function seemed most logical because of adult familiarity using computers for word processing. During the first decade of widespread computer use with young children, drill and practice activities to develop "readiness" skills such as letter naming and beginning word recognition dominated the scene (Fitch & Sims, 1990). Perhaps adults felt that children needed to use computers for a watered-down, skill specific literacy function. In the early to mid 1980's, educational researchers began discussing emergent literacy which viewed children's early scribbling and invented spelling as real, not prerequisite readiness behaviors (Sulzby &Teale, 1991). Another hallmark of the emergent literacy movement is the belief that preschoolers must observe and be engaged in literacy-related activities in which reading and writing is used to accomplish real goals, e.g., making a grocery list, following a recipe (Teale & Sulzby, 1989).

Using literacy to accomplish real tasks gave the computer a new role in the education of young children-story reading and writing. Children using word processors, especially talking word processing software and who have teachers scaffolding or providing the support for parts the children cannot do, write more, are less worried about making mechanical errors, make fewer mistakes, and produce high quality content (Clements, 1987). Word processing with computers seems to support a constructive writing process and invented spellings, more so than when children write with traditional

tools (e.g., pens, pencils, crayons) (Cochran-Smith, Kahn, & Paris, 1988). In general, children who write with word processors seem more motivated to write than when they just have pen and paper (Guidemi & Mills, 1989).

Cohen (1993) reported development of second-language writing abilities in preschoolers through use of a talking word processor. The program used in this study, Composition (1985), presented words first then the picto-graphic representation of the words after the child chose the words. The words, letters, and pictures were spoken through the voice synthesizer. She reported that children, ages 3-6, developed writing skills as they were "able to send their stories to others, and this gave them an experience of the functionality of written language" (p.28). Cohen even goes so far to say that in this study of teaching French to non French speaking preschoolers that written language developed before spoken language. She felt that through use of a computer with a voice synthesizer and software that connected print and graphics that the children, "wrote to read, read to speak" (Cohen, 1993, pp. 27).

In an earlier study, Anselmo and Zinck (1987) were initially concerned how non-reading preschool children would use the software they had available to them at that time. They planned to make picto-graphic representations of the written menu and directional items. They discovered, however, that the children had mastered using the keyboard letters for the commands they needed with several weeks and could independently select necessary menu items within several months without direct instruction. The children were reading, comprehending and using, letters and words in a context needed to control their environment, i.e., to use the software.

Overall, children tend to write and tell longer and more elaborate stories about computer graphics than they do about static pictures (Riding & Tite, 1985; Warash, 1984). Children also talk, draw, and write more with open-ended rather than drill and practice software. When using alphabet naming software and an alphabet book with their parents,

preschoolers were found to be interactive while their parents looked at the book with them (Worden, Kee, & Ingle, 1987).

Mathematics. As in other areas of educational development, computers have significantly increased preschoolers' early math concepts such as shape recognition, counting, and sorting (Clements & Nastasi, 1993). Similar caution should be taken in computer use to develop mathematic abilities as has been noted in other areas: drill and practice activities should be used sparingly and only after a concept has been learned through manipulative and other modes of experience (Clements & Nastasi, 1993).

Social/Emotional. Perhaps because this domain was of greatest concern when computer use with young children was initiated, more studies were found regarding social and emotional growth than any others. Over a decade of research indicates that children often develop a sense of self-efficacy, self-esteem, and overall satisfaction with their performance when using computers (Barnes & Hill, 1983; Swigger & Swigger, 1985; Cohen, 1993). Their self esteem helps them in their interpersonal relationships as well (Donohue, Borgh, & Dickson, 1987). Young children actually prefer to work at the computer in pairs or small groups and much cooperative learning has been observed in relation to computer use (Dwyer, 1994; Shade, Nida, Lipinski, & Watson, 1986). Cooperative work at the computer is fostered by type of software (e.g, open-ended exploratory and problem solving software as opposed to drill and practice types), teacher mediation (setting cooperation rules, explaining software function and features), and child familiarity with hardware and software (Clements, 1993).

Early computer use is felt to decrease the slight gender differences in computer use seen among older elementary and middle school children (Clements & Nastasi, 1993). These gender differences include a tendency for boys to use computers more than girls (Lieberman, 1985) and greater overall computer competency exhibited by girls (Jones, 1987).

Factors Affecting Successful Technology Integration.

In spite of the tremendous positive impact that has been reported over the past decade in regard to the use of technology in the education of young children, this impact has been less than prophesied and teachers, for the most part, continue to use traditional materials and strategies (Means & Olson, 1994). They teach the way they were taught (Smith & O'Day, 1990). Why isn't technology being used more effectively and consistently with young children? Barri . s and bridges to effective integration of technology as a tool and a process in early childhood curricula implementation is summarized below.

Television/Video Technology. These two areas are combined because reports of use with young children are limited and cautions and kudos for their use are similar. Interactive television and video development and use has encouraged communication skills in kindergarten children. Children were helped to write and present news, stories, and plays and then watch and discuss their presentations (Curtin, et.al., 1994). These children appeared to learn and communicate information when they new it would be heard and viewed by other.

The major cautions as indicated above is to limit school use of commercial television/video viewing to programs which are educational in nature and which augment a goal, concept, or theme in the curriculum. Parents should be informed of the dangers of too much unlimited television viewing, especially when there is no adult mediation of program content. VCR's can be used to control children's access to content by providing only appropriate videos for viewing. Access to use of technology along with parental support and instruction can empower even preschoolers with knowledge and skill to control their environment and to make better choices for their own entertainment (Krendl et. al., 1993). The simple VCR can be an early technology that young children can use as a tool to achieve a purposeful goal.

Choat and Griffen (1988) suggested that videotaped television programs are superior to children watching programs as they occur because they may be stopped for

discussion. These pioneers in use of electronic media for educating young children refer to use of VCR' as a poor-man's Interactive video. Teacher and parent mediation of television viewing can be greatly facilitated by showing pretaped programs on a VCR and stopped, started, and rewound or fast forwarded to emphasize points of discussion. From the limited information available on video use with preschoolers, the following suggestions for use have been gathered:

1. Small group rather than whole class viewing of the video;

2. Previewing with frequent stops for children to discuss and ask and answer questions;

3. Independent control of video viewing by the child so that he or she may stop it for discussion, fast forward or rewind it to find favorite parts (Choat & Griffen, 1988).

Commercially available videodiscs and laser discs suitable for preschool children are limited. Readers are referred to the California Index of Instructional Video for current listings of this type of educational media.

Computers/Software. Descriptions of how computers are actually used in a preschool classroom are less clear than are reports of computer use effectiveness. Computer use studies fall along a continuum of a separate activity center offered as a choice just like blocks or house keeping centers to a more integrated tool used to type and print the classroom news as it is dictated by the children to the teacher during morning circle (Anselmo & Zinck, 1987; Buckleitner & Hohman, 1987). Donohue, Borgh, & Dickson (1987) offer a more in-depth description of how computers were introduced to children and teachers in 24 day care centers. Computer use was formally taught to individual children or mall groups of 2 -3 children. The children used computers at their or their teacher's request in pairs with adults loading software, showing children how to use a new piece of software and then allowing children to use the computer on their own. Interview data gathered through this study revealed that the following characteristics must be in place for successful integration of computers into a preschool curriculum:

• One person on staff at a preschool must assume responsibility for the computers and software but train and involve others in decision making regarding software selection and how computers will be used;

• Clear goals on how computers will be used to support the existing curriculum must be established and software that will support these goals purchased;

• Operational guidelines regarding times for use, levels of adult supervision needed, and set-up, operation and problem-solving must also be established as computer use is introduced into a preschool setting (Donohue, Borgh, & Dickson, 1987).

Developmental impact appears to be greater when the computer is used as a support to an active learning environment, not as an end goal in and of itself (Buckleitner & Hohman, 1987; Donohue, Borgh, & Dickson, 1987). To learn to use a computer would not be an appropriate goal, but to learn to write, draw, talk, read, count by using a computer would be more effective and appropriate for young children. Computers should not be used for drill and practice, electronic worksheet activities, but as tools to accomplish real purposes and to allow children to explore (Clements & Natasi, 1993). Current efforts at educational reform are developing more collaborative and constructive educational environments. These settings provide a better match for the integrated use of technology as a tool to accomplish real tasks (Means & Olson, 1994).

Buckleitner & Hohman (1987) also suggest that children learn best when taught a concept with manipulative materials first before showing them how to do an activity targeting the same concept on the computer. They introduced approximately 1 new computer activity per week within their preschool in this manner. Anselmo & Zinck (1987) found that the children used the computer for longer periods of time and more effectively when left to explore software on their own. They did indicate, however, that younger children (age 3) may have used the computer more with some direct instruction. In general, older preschoolers (4 years and older) appear to be more engaged during computer play than younger children (Clements & Nastasi, 1993; Hoover & Austin, 1986). Younger

children still benefit and seem to enjoy using computers but need more direct instruction and more time to learn to use software and keyboard commands.

Another important factor in effective use of computers and appropriate software is teacher and other staff training and time to experiment with hardware, peripherals, and software themselves (Buckleitner & Hohman, 1987; Donohue, Borgh, & Dickson, 1987). A decade of research continues to indicate that parents and practitioners need intensive training and technical support on the most appropriate and effective ways to use technology as a tool for learning and independent function. In preschool programs where teachers have not received preliminary and follow-along training, use of computers has been tenuous at best (Hutinger, Robinson, & Johanson, 1990). Approximately seven years of support, planning, and training are needed before teachers fully integrate computers and other technology into their curricula (Sheingold & Hadley, 1990). Teachers continue to question spending on computers rather than traditional educational materials because their computers are turned off more than they are turned on. Some teachers report that computers were purchased for their classroom in response to parental demands rather than in response to their own requests (Peck & Dorricott, 1994). These teachers have not had adequate training on the potential of computer use and more importantly, on how to use computers effectively within their classrooms.

We have found that teacher familiarity, confidence, and skill in choosing software and integrating into the curriculum is dependent upon teacher training and time for self-directed exploration and learning (Koppenhaver, Staples, et.al., 1994). Parents and teachers who regard a computer as an effective personal tool for themselves are more likely to embrace and use this technology with young children (Hutinger, Robinson, & Johanson, 1990). These factors also significantly effect the quality and quantity of technology use with today's preschool classrooms (Koppenhaver, Pierce, et.al, 1994). When computers were first introduced into the schools, they were placed in labs to limit access and thus control when and how students used them (Betts, 1994). Even today,

computers in preschool classroom are being used primarily as an assigned center-time event with non-integrated activities such as game playing or exploration with little interaction or explanation, activities found to be less effective in the earlier literature (Koppenhaver, Staples, et. al., 1994).

Perhaps computers continue to be used as an end instead of a means to an end because educators have not yet headed advice in 1987, educators must determine goals and expectations for computer use realistic and relative to the curriculum (Anselmo & Zinck, 1987; Buckleitner & Zinck, 1987; Donohue, Borgh, & Dickson, 1987). In the ACTT (Activating Children Through Technology Curriculum) children do not use the computer as an electronic worksheet doing drill and practice activities, but draw write, and explore in thematically related activities (Hutinger, Robinson, & Johanson, 1990). For example, when studying turtles, the children dressed up like turtles, read books about stories, and then played a computer game that featured turtles moving through a maze. The most effective uses for computers for young children include developing early writing, creativity, and artistic abilities, fostering comfort in a technology driven society, and freeing teachers for more human interaction and development of better learning environments (Peck & Dorricott, 1994).

In addition to appropriate goals for computer use and sufficient staff training, beneficial use of computers is dependent upon appropriate software selection. At last count there were approximately 500 pieces of commercially available software deemed appropriate for use with preschoolers (Buckleitner, 1994). Buckleitner, author of the High/Scope Buyer's Guide to Children's software, suggests that preschool classroom software libraries should contain at least four types of software:

1. Some programs that focus on early skills such as letter recognition and counting. This type of program should be used as for highly successful practice after children have learned a concept through more traditional approaches (e.g., manipulatives).

2. Open ended tools such as writing and drawing software (e.g.,Kid Pix by Brøderbund and Kid Works 2 by Davidson);

3. Playful exploratory programs that teach concepts with entertaining animated graphics and which give positive feedback and foster success. There are no right and wrong answers in exploratory software. These programs often offer a choice of exploratory (touch a letter hear its name) and question and answer formats (e.g., The Playroom by Brøderbund). Good software that has a question and answer format scaffolds or leads the child to the correct answer by giving cues and positive rather than negative feedback.

4. CD-ROM story books which feature instantaneous animation, sound, and voice output when the child selects any item on the screen (e.g., Just Grandma and Me by Brøderbund) (Buckleitner, 1994)..CD-ROM storybooks allow children to read at their own pace, repeating lines of text when desired, having the computer speak words they do not know, and to manipulate characters within a story. CD-ROM offers a wide range of teacher control options such as language the text is spoken in or if the story is read aloud at all. Parham (1993) offers a thorough review of CD-ROM stories and their features that are currently available.

These types of software can be used by a variety of children for several purposes. Choosing good software from the vast array that is available depends upon the goals planned for computer/software use and the children who will be using it. Most children can use any type of software but certain characteristics make some software more appealing to children, and other characteristic make some software more appealing to their parents and teachers. The following guidelines should be considered when evaluating software:

• Should be "child friendly". Programs appropriate for preschoolers should be easy for them to use by offering simple picture menus and meaningful icons (e.g., pencil eraser for "undo" function);

• Should be flexible enough to meet a variety of educational needs and goals. As mentioned above, the better software programs feature a range of exploratory and drill and practice options, both of which are success oriented and offer positive feedback and cueing.

• Should be colorful, animated, quick to respond. Young children prefer action oriented software and programs that talk and have other sound effects..

• Has teacher control options. Many good programs are available that have controllable features like color or sound control and language in which the menu is presented. Teachers may format the program to meet different child needs and preferences. Some of the newest pieces of early childhood software also keeps records of student performance.

A list of literacy software currently being used with preschool children with and without disabilities by staff at the Center for Literacy and Disability Studies is included in the appendix along with software resources and an evaluation form. Buckleitner (1994) highlights newest innovations in software for other areas of preschool education.

Assistive Adaptations

Assistive technology has been used with young children with disabilities for over thirty years to help them to learn and to independently care for themselves, move, communicate, and otherwise control their environments. Technology is especially critical for these youngsters because it is necessary to help them to function as independently and as effectively as possible. Lewis (1993, p. 7) conceptualizes the benefits of assistive technology use to children with disabilities by the "ABC Model: Augment abilities, Bypass of Compensate for disabilities."

An area of concern which may be ameliorated by using both technology and assistive technology with young children with disabilities is their limited range of educational experience (Cosden, Gerber, Semmel. et.al., 1987). Up until recently, most children with disabilities were taught in self-contained settings with prescribed educational

goals based on diagnostic information. While this approach may have individualized instruction, a variety of information and experience was not as available to these children as it is for children in mainstreamed classes. The vast menu of computer software and educational television programming may provide some vicarious experiences to children with disabilities. Adaptive access to the computer and interactive video may help children with severe physical impairments feel some control over their environments.

Television. Most of the information available regarding television use in the education of young children with disabilities falls within three categories: (1) physical access for children with physical impairments to independently control televisions, (2) the use of closed-captioned (CC) television with children who are hearing impaired, language impaired, or learning disabled to increase literacy skills, and (3) closed-circuit television magnification.

Physical access to television controls may be achieved by adapting a remote control device or by purchasing a commercially available adapted remote control through resources such as Toys for Special Children. Users are cautioned at using television videos for teaching or providing practiced for adaptive switch activation. Beginning switch users are sometimes set up in front of a television which is plugged into a timer unit (e.g., the Power Link from Ablenet). The television or video will stay on for a certain amount of time determined by a teacher or therapist. The child will watch the program, become engaged in it, and then it will turn off. The child will have to hit his switch to reactivate the TV. Even though well intentioned therapists and teachers may think that they are teaching cause and effect or early switch use with a strong motivator, but it has been our clinical experience that this activity frustrates a child and he or she soon looses interest in the video or program and discontinues using the switch. Other cautions for using adaptive switches are included in Buysse (this volume).

Closed-captioning of television programs was originally developed for adults with hearing impairments. Closed-captioning prints near-verbatim renderings of what is being

said on the screen. Audio-captioning for persons with visual impairments is also become more readily available on commercial television. Audio-captioning provides a subtle voice over description of what is occurring visually on a screen. Closed-captioning has been successfully used with elementary and middle school students with learning and language impairments to improve reading (). As reading ability develops, however, closed-captioning can become confusing for children who hear as well as see because the text does not match speech output word for word.

Closed-circuit television (CCTV) magnification enlarges any type of reading materials so that they may be read by persons with low vision. CCTV uses a camera with a zoom lens, a monitor, and a viewing table. Images can be enlarged to meet user visual needs (Lewis, 1993).

Video Technology. Much of the information in the literature concerning use of video and interactive video with persons with disabilities centers around teaching life skills to high school aged students. Significant advances in their problem solving, communication, and other "life skills" using interactive videodisc and teaching strategies have been reported (Browning, Nave, White, & Barkin, 1985). Interactive videodiscs were also used to teach social skills to elementary students who were deaf. These students received higher peer acceptance than those taught social skills through more traditional means (Thorkildsen, 1985).

Videos have been used to develop early literacy skills with two groups of children with disabilities. First, children with severe hearing impairments whose first language is American Sign Language are taught to write captions for videotaped stories which are told in ASL. They type their captions into a caption machine which super imposes print at the bottom of the screen. These elementary age children are helped with corrections and revisions of their captions (Kelly, et.al., in press).

Use of interactive videodiscs with hearing impaired youngsters has received favorable attention over the past several years. Nearly a decade ago, Jones (1986)

developed four interactive videodisc to teach verb tenses, reading comprehension, and basic reading and writing skills to young deaf children. Another disc was designed to teach British Sign Language to the hearing parents of deaf children. Stewart (1991) also used videodiscs to teach sign language to the hearing friends of deaf children as well as English language syntax to American Sign Language (ASL) users. Use of these videodiscs produced significant results and were felt to be superior to traditional teaching methods because action and language could be more closely linked via this technology. A little more recently, Hanson & Padden (1989) and Copra (1990) used interactive videodisc technology to develop English literacy in deaf children who used ASL as their primary means of communicating. These discs allowed young deaf children to view a story told in ASL, printed in English, and to answer questions, write a story, or caption the story they had seen. Videodisc technology's strength lies in the ability to conjoin multiple methods of communicating for children to link and learn their language to other languages.

Videotapes of books have also been used with children and adults with severe physical impairments which hinder their ability to independently turn pages. Close ups of pages and persons reading text while pointing to words can be shown for children to watch as a leisure activity. Pages can also be "freeze-framed" for independent reading or looking at pictures by adapting a remote control for a VCR. The user can activate the pause control via an adaptive switch to hold a page for as long as he or she wishes to look at it. A four-head VCR should be used with this approach for clear, non-jittery frames (Johnson & Pierce, 1993).

This approach to providing access to books and periodicals has its major components in items which often already exist in the household including a standard four-head VCR and video camera. The only adaptations required involve removing the cover from the remote control and connecting two wires to the "freeze" (still) function switch. These wires are then connected to a jack capable of connection with the individual's

adaptive switch. This minor modification does not interfere with the normal operation of the VCR by other users and can be performed by anyone capable of using a soldering iron.

The focus of this approach is to record books and magazines on videotape for later utilization by persons with physical impairments through activation of an adapted switch connected to the "still" function. When the switch is activated, the VCR "freezes," thus providing access to the page of the book displayed at that point in time.

The actual recording of the books is simple and not time-consuming. Users of this approach are cautioned to record materials purchased solely for a specific individual. Use of the video with multiple users might be considered a violation of copyright law. Users are advised to contact the publishers of the text they wish to adapt to obtain permission. It is doubtful that requests would be denied when publishers are advised of your purpose.

To record, simply position the book on a flat surface. Place the camera on a tripod and adjust the camera angle and zoom to enlarge the page as much as necessary. The size of the print and page is limited only by the size of the television screen for tape replay and by the limitations of the camera used in videotaping. After activating the record function, "thumb through" the text while maintaining the image in the camera view finder. A slight pause before turning the page is required to allow the eventual user time to activate the "freeze" switch during playback. Experimentation with the rate of page turning during the recording process may be necessary for use with individuals who are not adept at using their adaptive switch.

Variations of this approach are available for special purposes and for use with special populations. As previously mentioned, the text on each page of a book or periodical can be dramatically enlarged using the zoom feature of the camera during recording for persons with visual impairments. Direct audio coupling of the VCR is an option for hearing-impaired users with FM systems and compatible hearing aids. Individuals who have limited functional motoric ability for activating switches would benefit by using this approach without the "freeze" adaptation. In this particular

application, one simply records the book and allows enough time between pages to provide the user adequate access to each page.

With this method, the preparer has the option of reading the book and recording voice on the videotape for playback if desired. The capability of providing simultaneous audio feedback with the visual images of text and pictures is an ideal literacy teaching tool. Individual words or phrases can be highlighted for viewers with a flashlight while a speaker reads the text. This option combines access to print, pictures, and reading of the text for excellent support in developing a beginning reader's skills.

Computers and Software. Computers have been used to enhance development and function in preschool children with disabilities possibly longer than with typically developing children. Spiegel-McGill, Zippiroli, & Mistrett (1989) found that computers can help develop social skills in preschool children with social deficits and speech-language impairments. The computer games used in this study served as a point for joint attention and facilitated social interaction between children with and without disabilities. Spiegel et. al. felt that children with communication and social delays may need the structure and support offered by a computer and software to initiate and maintain social interactions. The Illinois Head Start Project adapted the Macomb Project computer curriculum which had been written for children with disabilities feeling that a computer can "equalize play and provide a voice for communication" for children with different language and physical abilities (Hutinger, Robinson, & Johanson, 1990, p. 33). Children with severe hearing impairments were given literacy instruction using a computer and a word processing program similar to the one described by Cohen (1993). The program used in this study also visualized the American Sign for the word and picture chosen by the child. After only six weeks of this instruction, the children showed significant gains in word recognition and identification, and realized they could communicate by writing as well as by signing (Prinz, Nelson, & Stedt, 1982). Meyers (1984) also demonstrated significant gains in written language abilities in non-speaking preschoolers via word processing and

other types of computer use. Steelman, Pierce, Alger, et. al. (1993) found emergent literacy development in preschool children with severe, multiple impairments. One aspects of their intervention program was daily use of the computer to read, write, and speak.

A rich history of success exists in using computers with children with learning disabilities. Many of these children have been shown to write more eagerly and continuously with word processors rather than paper and pencil (MacArthur & Shneiderman, 1986). All children, especially those with learning difficulties, tend to produce more literacy and mathematical work with computers but they need a substantial amount of teacher scaffolding and mediation to be as successful as possible (Cochran-Smith, Kahn, & Paris, 1988)..

Any child can use a computer given the vast array of adaptive access devices and the software choices currently available. Children may use computers with adaptive switch via a selection technique called scanning where the keyboard or other control buttons move across the screen until selected by the child by hitting his switch. Children with more motor control of any body part or who use a head stick or other adaptive pointing device may directly select desired keys or other functions on overly large or small keyboards (e.g., Unicorn Boards, Intellikeys, Power Pads). Software selection should follow the same suggestions give for all young children. Several special education software companies do produce programs especially tailored to meet goals such as vocabulary development, and appropriate syntax use. These programs may be used for independent practice but children with disabilities should also have access to exploratory and tool software so that they may also develop problem solving, artistic, and communication skills. Software that talks, e.g., Write Out-Loud, Kid Works 2 is especially beneficial for children with disabilities because speech output improves understanding, literacy abilities, and can be used as a communication system for children with severe speech impairments.

Other Assistive Technology Options

Many of the examples of using technology and assistive adaptations of equipment described above have been for the purpose of enhancing cognitive abilities and for some independent access to leisure activities. Children with disabilities have a range of special needs which necessitate the use of assistive technologies to aid in development, use, and independence in other areas. Descriptions of some of the current assistive technology options in the areas of mobility, self-care/environmental control and communication and suggestions for integration into preschool classrooms and curricula follows. See Buysse (this volume) for a description of toy adaptation for facilitating play in young children with disabilities. There are myriad devices that assist even the youngest child with mobility, self-care, environmental control, and communication. Readers are referred to Lewis (1993), Male (1994), and the list of resources found in the appendix for excellent reviews of current assistive technology to meet these needs.

Recommendations:
Technology Development and Use with Young Children

Technology becomes outdated about as soon as it is available to the public. Something newer and better is always on the horizon. This chapter, therefore, has not focused on suggesting current educational television or video programming, software, or hardware but ways to use technology which may remain constant but hopefully improved as knowledge progresses. Newer technologies have not and still do not mean improved teaching or learning. Past, current, and future concerns and suggestions for technology use in preschool classrooms and for development of newer and better technology are summarized below.

Technology Transfer

Technology transfer refers to the development of new technology that speaks to the needs and interests of actual children, teachers, and families. The best or most appropriate technology has been developed in response to real consumer needs. Currently, technology development and use in the home often outpaces that at school (Betts, 1994). Teachers and parents must communicate with technology developers with their needs for future

technology development and with feedback on current technology that is being used at home and at school. The Communication Aids Manufacturers Association (CAMA) was initiated for this purpose. This group of developers from different companies are available for consumers to provide feedback regarding their communication systems. In this way, Stephen Hawking helped to develop his own voice output system which is now used by many non-speaking persons world-wide.

Technology Integration

When working with young children, teachers and other care givers should adhere to the caveats of Developmentally Appropriate Practice (DAP) (Bredekamp, 1992). Technology, television, videos, computers, and assistive devices can be one method of following or providing DAP. The essential characteristics of a curriculum or program which provides DAP include:

1. Activities which stimulate physical, emotional, social, and cognitive growth in an integrated fashion;

2. Activities are planned and implemented according to child's special interests and developmental progress;

3. Learning activities are active and interactive and support exploration;

4. Activities and materials are real and relevant to the lives of the children

As a tool, technology can be used by any child at any developmental level to accomplish real goals or just explore and enjoy. Television/video programming can be used to augment stories read in class. Children can also re-enact television and video programs, do thematically related activities related to what they have seen and heard, and tape and watch themselves using technology.

Learning to use the computer should only be a secondary objective (Muir, 1994). Learning to communicate, to draw, to color, to share and take turns-those preschool goals should be primary and one way of learning them is to use the computer. Computer based activities offer "more bang for the buck" because they can be done independently, freeing

up teacher time to play and talk with other children; computers present text, graphics and speech simultaneously which helps link these modes of communicating together for young children which is a necessary emergent literacy skill; computers offer a variety of modes of output to meet the needs of various learning styles; computers are motivating and fun for most children computers can be used by any child via adaptive access devices and are thus an equalizer. With a computer, Johnny with disabilities can draw, color, scribble, and talk just like the other children.

Example Goal	Example Software	Example Teacher Mediation
Jane will ask "Wh" questions.	MacGee	Teacher views program with Jane and plays a game asking "What do you see?"
Bobby uses N+V combinations imitate the	Playroom	Bobby clicks on random animals in the playroom. His therapist models N+ V combinations for him to about the actions on screen.

Technology can be appropriately integrated into a preschool classroom and help to provide DAP to a variety of learners in an engaging format. Technology can empower children to take a more active role in their learning (Betts, 1994);

Appropriate Choices

Before any type of new or existing technology (hardware, software, and programs) is purchased or used with young children, teachers, parents, and administrators should try it out themselves and evaluate it in the following areas:

• curricular match: Will using the technology support instructional concept, themes and philosophy of the educational curriculum, program, and/or the teacher?

• instructional design: Is the technology and it supports age appropriate? Are the objectives for its use clear?

• content: Is content thorough, current, and free of stereotyping, demeaning language or explicit, violent action or graphic?

• interest: Will the technology and its supporting materials and use be able to be used for real purposes and to promote problem solving skills? Will it engage students?

• technical quality: Does its features support its use and communicate its contents? (Bakker & Piper, 1994). A list of technology evaluation resources is included in the appendix. Additional suggestions are listed below.

Good Software for Young Children Should:

• Be open ended and encourages exploration and imagination. (A list of current software meeting suggested guidelines and a software evaluation protocol are included in the appendix);

• Be animated, interactive, & problem-solving oriented;

• Engender cooperation;

• Talk.

Good Television/video programming for Young Children Should

• Be structured and slow paced;

• Re-enact stories;

• Be non-violent;

Television, videos, and interactive videodiscs are, like other technologies, most appropriately used as an integral part of the existing curriculum. This media can be used for communication skills development as children write and present class and family news via television and video. It should also be used as a resource tailored to meet child interest and needs. Portions of videos and taped television programs should be shown to explain or emphasize concepts being worked on in class and/or to augment some area of child interest (Choat & Griffen, 1993).

Needed Areas of Development

As new technology continues to emerge, manufactures may wish to keep the following needs in mind, especially for children with disabilities and special needs and interests like children who are non-native language speakers:

• Wireless technology for infants and toddlers. Even very young children need access to adaptive toys for learning and enjoyment to be enhanced. For safety and normalization to occur, manufacturers should develop wireless access approaches for this very young population.

• Accessible word processing software. It is very difficult For children with severe physical impairments to color, draw, scribble, and write. Even with the adaptive access devices, this remains a very challenging process to the child and his caregivers. Manufactures of early word processing software would help this population to not become so delayed in their writing abilities if the software itself was more readily adaptable to children who have to rely on single switch access for activation.

• More and better educational videos, videodiscs, and television programs. Currently titles in these areas of electronic media are limited for very young children that have sound instructional design and educational value.

• Improved multimedia product development and use to meet the multiple learning styles that images, text, animation, and speech/sound effects offer a wider variety of children (Betts, 1994).

Adult Mediation and Scaffolding

One of the most beneficial ways to use existing electronic media is to ensure the human component- what teachers and parents say and do about and with technology and educational materials. Before, during, and after programming, talk with children, present alternative views and approaches than those offered in the program evaluative criticism, interpretation of content, rule making (Desmond, Hersch, Singer, & Singer, 1987). As previously mentioned, taped television programs shown on VCRs offer teachers and parents control to stop and start the program for discussion (Choat & Griffen, 1988).

With computer work, adults should teach a concept with manipulatives first, offer initial training and support, wait for child to ask for help, monitor to make sure child is not getting frustrated and that cooperation and sharing is occurring. Parents and teachers may

need to teach cooperation with very young children. Adults should always talk with children after they use computer to get feed back on task and social related issues.

Continuing Education and Support for Parents and Teachers

As previously stated, one of the major reasons technology has not been successfully integrated into the preschool curriculum is a lack of adequate teacher preparation. One-shot workshops are an ineffective approach (Hurst, 1994). "Training for technology simply can't be done on the fly or after hours (Driscoll, 1994, p. 82)." More effective inservice training provides modules from which adult learners may chose content that they need, follow-along technical support, and usually involves teachers and administrators in planning and implementation (Hurst, 1994). Model demonstration classrooms in which teachers learn to use technology in context with real children and for real purposes is also a superior approach to inservice training (Curtin, et.al., 1994). Time must be provided for teachers to use and experiment with technology and to learn, teach, and network with one another about how to integrate technology into their classrooms, their lives, and into their students lives (Driscoll, 1994).

Technologies old, current, and new will only be as effective as the people who use them and teach children to use them. Parents and teachers alike need to know about the dangers of allowing children to watch television unsupervised; provide alternative activities-videos, stress co-viewing, active watching (Clements & Nastasi, 1993). The keys to effective technology use with any young child are integrated and interactive.

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Assistive Technology Resources

Goosens', C., Crain, S., & Elder, P. (1992). Engineering the classroom environment for interactive symbolic communication: An emphasis on the developmental period, 18 months to five years. Southeast Augmentative Communication Conference, 2430 11th Ave. North, Birmingham, AL, 35234

Baumgart, D., Johnson, J. & Helmstetter, E., (1990). Augmentative and Alternative Communication Systems for Persons with Moderate and Severe Disabilities. Baltimore, MD: Brookes Pub. Co.

Burkhart, L. (1993). Total augmentative communication in the early childhood classroom. 6201 Candle Court, Eldersburg, MD, 21784.

Crestwood Company, 6625 N. Sidney Place, Milwaukee, Wisconsin, 53209-3259, (414) 354-5678. Nice catalogue of early communication aids.

Don Johnston, Inc., P.O. Box 639, 1000 N. Rand Rd. 115, Wauconda, IL, 60084-0639, (800) 999-4660. Many augmentative communication and computer resources.

Mayer-Johnson C., P.O. Box 1579, Solana Beach, CA, 92075-159, (619) 481-2489. This company offers Picture Communication Symbols and accessories.

Musselwhite, C. (1988). Communication programming for persons with severe handicaps. Austin, TX: Pro-Ed, 5431 Industrial Oaks Blvd., 78735

Emergent Literacy Resources

Adaptech, ISU Research, 2501 N. Loop Drive, Ames. IA, 50010. This company sells VoicePad Switches (tape switches) and the LinkSwitch which can be used to give voice output to books.

Ablenet, 1081 Tenth Ave. S.E., Minneapolis, MN 55414., (800)322-0956. This company sells digitized augmentative communication devices (The Speak Easy) which can be used with story reading and the slide projector switch adapter.

Big Book Maker software. Toucan, a division of Queue, Inc., 338 Commerce Drive, Fairfield, CT, 06430, (800)-232-2224.

Crestwood Co., 6625 N. Sidney Place, Milwaukee, Wisconsin, 53209-3259, (414) 352-5678. This company sells the talking card reader which can be used to give children a way to talk during story reading.

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Strickland, D. & Morrow, L. (1989). Emerging literacy: Young children learn to read and write. Newark, DEL: International Reading Association.

Toys for Special Children, 385 Washburton Ave., Hastings-on-Hudson, NY 10706, (914) 478-0960. Sells adapted remote controls for TV's and VCR's.

Trelease, J. (1992). The read-aloud handbook. New York: Penguin Books. This is an excellent resource for children's books and suggestions for interactive reading.

The Wright Group, 10949 Technology Place, San Diego, CA, 92127. Excellent resource for emergent level books.

Software Resources

Broderbund
500 Redwood Blvd.
Novato, CA 94948-6121
(800) 521-6263
The Playroom (Macintosh, Apple II, MS-DOS)
Kid Pix (Macintosh, MS-DOS)
Just Grandma and Me (Macintosh, MS-DOS)
The Treehouse (Macintosh, MS-DOS)
The Manhole (Macintosh, MS-DOS)

Creative Communicating
P.O. Box 3358
Park City, UT 84060

(801) 645-7737 Phone & fax
PowerPad software for IIe, IIGS, IIe emulation on Mac
StoryTime Powerpad Series (10 stories)
StoryTime Just for Fun (5 additional stories)
Magic Hats
Hide & Seek with Fluffy
Five Little Frogs
Five Little Fish
Mystery Box Surprise
Mystery Holiday Box Surprise
Bus to School
StoryTime Tales (book)

Davidson and Associates, Inc.
P.O. Box 2961
Torrance, CA 90509
(800) 556-6141 Customer Support
(800) 545-7677 Sales
KidWorks 2 drawing (Macintosh, MS-DOS)

Discis Knowledge Research, Inc.
P.O. Box 66
Buffalo, NY 14223-0066
(416) 250-6537 phone
(416) 250-6540 fax
Applelink: DISCIS
Discis Books (Macintosh only)
titles:
The Tale of Peter Rabbit
The Tale of Benjamin Bunny
Thomas' Snowsuit
Moving Gives Me a Stomach Ache
The Paper Bag Princess
Mud Puddle
Cinderella

Don Johnston Developmental Equipment Company
1000 N. Rand Rd., Bldg 115
Wauconda, IL 60084
(800) 999-4660 or (708) 526-2682
StoryTime (Macintosh only)
CircleTime (Macintosh only)

Dunamis, Inc.
3620 Hwy. 317
Suwanee, GA 30174
(800) 828-2443
Power Pads and related software

Edmark
P.O. Box 3218
Redmond, WA 98073-3218
(800) 426-0856
TDD (206) 861-7679

Bailey's Bookhouse (Macintosh only)
KidDesk (Macintosh only)

KidTech (Macintosh only)
21274 Oak Knoll
Tehachapi, CA 93561
(805) 822-1663
Titles:
Make it Go (B&W) $20
My Action Book (B&W) $30
Old MacDonald's Farm (color) $50
Old MacDonald's Farm (B&W) $30
Five Little Ducks (color or B&W) $50 or $30

Lawrence Productions
1800 S. 35th St.
Galesburg, MI 49053
(800) 42104157
McGee (Macintosh, Apple IIGS, MS-DOS, Amiga)
McGee at the Fun Fair (Macintosh, Apple IIGS, MS-DOS)
Katie's Farm (Macintosh, Apple IIGS, MS-DOS)

Mayer Johnson Company
P.O. Box 1579
Solana Beach, CA 92075-1579
(619) 481-2489 phone
(619) 259-5726 fax
Speaking Dynamically™ (Macintosh only)
I Can Play, Too!™
Boardmaker™ (International)

Merit Software
13635 Gamma Road
Dallas, TX 75244
Electric Crayon Deluxe Series (Macintosh, Apple II, MS-DOS, Amiga, Commodore 64)

PLAYWARE, Play and Learning Software for Youth
P.O. Box 44076
Kennesaw, GA 30144
Single switch and Power Pad input software

R.J. Cooper & Associates
24843 Del Prado Suite 283
Dana Point, CA 92629
714-240-1912
Single switch programs good for young children

Tom Snyder Productions
90 Sherman St.
Cambridge, MA 02140
(800) 342-0236
Tom Snyder lapware (Macintosh, Apple II, MS-DOS)
Jack and the Beanstalk
Flodd, the Bad Guy

Tough Krudd

UCLA Microcomputer Team
1000 Veteran Avenue, Room 23-10
Los Angeles, CA 90024
(213) 825-4821
Single switch, Power Pad, and TouchWindow software

Books on Computers and Other Resources:

Burkhart, L. (1987). Using computers and speech synthesis to facilitate communication with young and/or severely handicapped children. 6201 Candle Court, Eldersburg, MD, 21784

Carolina Computer Access Center
Alliance for Technology Access
(Judy Timms)
1307 Solano Ave.
Albany, CA 94706
(415) 528-0747
This resource has published a guide for using computers with infants and toddlers.

California Technology Project
P.O. Box 3842
Seal Beach, CA 90740

California Index of Instructional Video
c/o the California Instructional Video Clearing House
(209) 525-4993

CAST, Inc. (Center for Applied Special Technology)
39 Cross St.
Peabody, MA 01960
(508) 531-8555

Closing the Gap
P.O. Box 68
Henderson, MN 56044
(612) 248-3294

Developmental Evaluations of Software for Young Children by Susan W. Haugland and Daniel D. Shade
Delmar Publishers, Inc.
2 Computer Dr. West
Box 15-015
Albany, NY 12212

Educational Resources
1550 Executive Drive
Elgin, Illinois 60123
(800) 624-2926
(708) 888-8499 fax
(708) 888-8689 fax

High/Scope Survey of Early Childhood Software, by Warren Buckleitner
High/Scope Educational Research Foundation
600 North River St.
Ypsilanti, MI 48198
(313)-485-2000

Lekotek
1955 Cliff Valley Way
Atlanta, Georgia 30329
(404) 633-3430

MacWarehouse
47 Water Street
Norwalk, CT. 06854
(800) 622-6222 phone
(203) 855-1386 fax

Salpeter, J. (1992). A Parent's Handbook: Kids & Computers. SAMS: A division of Prentice Hall Computer Publishing, Carmel: Indiana. ISBN: 0-672-30144-x

TAM (Technology and Media)
Council for Exceptional Children
1920 Association Dr.
Weston, VA 22091-1598
(703) 620-3660

Trace Research and Development Center
S-151 Waisman Center
1500 Highland Ave.
Madison, WI 53705
(608) 262-6966

Worldwide Disability Solutions Group
Apple Computer
Mail Stop 36SE
20525 Mariani Ave.
Cupertino, CA 95014
(408) 974-7019
TDD (408) 974-7911

Independent software reviews:

Apple Computer Resources in Special Education Rehabilitation
DLM/Teaching Resources, Inc.
Park Allen, TX 75002
(800) 527-4747

EPIE (Educational Products Information Exchange)
P.O. Box 869
Water Mill, NY 11976
(516) 283-4922

Technology for Language Learning Special Education Public Domain Project

Software List (Updated: May 31, 1994)

Program	Age Group	Publisher	Approximate Price	Compatibility
AFC AFC Access: Touchwindow AFC: Library Setups Touchwindow: Edmark Unicorn Board (expanded, model) Unicorn Engineering		DJDE (see above)	 152.00 105.00 335.00 315.00	
AFC		DJDE (see above)		
Bailey's Book House	Preschool	Edmark (see above)	64.95	Macintosh
Big Book Maker™	Preschool School-age	Pelican, a division of Queue, Inc. 768 Farmington Avenue Farmington CT 06032 800 232-2224	49.94 35.95	Apple IIGS Apple IIe
Circletime Tales	Preschool	Don Johnston Devlopmental Equipment, Inc 100 Rand Road Building 115 Wauconda, IL 60084 708-526-2682; 1-800-999-4660	95.00	Macintosh

Create with Garfield	Preschool	DLM One DLM Park Allen TX 45002 800 527-4747 215 248-6300	25.95?	Apple IIe Apple IIGS
Discus Book Series	Preschool School-age	Mac Warenouse	19.00 each 389.00 Ed Pak	CD ROM
Electric Crayon: Holidays and Seasons, Dinosaurs are Forever, Letters for You	Preschool	Merit Software/ Potarware 13635 Gamma Road DAllas TX 75244 800 238-4277 214 385-2353	9.95 20.95/11.95	Apple IIe Apple IIGS
Facemaker™ Golden Edition	Preschool	Pelican (see above)	39.95 25.95	Apple IIe Apple IIGS
First Letter Fun	Preschool	MECC 6160 Summit Drive N Minneapolis MN 55430 800 685-6322 612 569-1500	29.95?	Apple IIe Apple IIGS
Fun from A to Z	Preschool	MECC (see above)	32.95	Apple IIe Apple IIGS
I Can Play Too	Preschool	Mayer-Johnson PO Box 1579 Solana Beach CA 92075-1579 619 481-2489	89.00	Macintosh
Kid Cuts	all ages	Broderbund	29.95	Mac
Kid Desk	Preschool School-age	Edmark PO Bix 3218 Redmond WA 98073-3218	39.95 27.95	Macintosh IBM

Kid Pix	Preschool School-age	Broderbund (see above)	37.95 59.95	Macintosh IBM
Kid Pix Companion	Preschool School-age	Broderbund (see above)	26.96 39.93	Macintosh IBM
Kid Works 2	Preschool School-age	Davidson & Associates	89.95	Macintosh
Living Book Series: Arthur's Teachers Trouble Just Grandma and Me	Preschool School-age	Broderbund (see above)	63.95 49.95	CD ROM
McGee	Preschool	Broderbund(see above) Educational Resources 800-634-2926	25.95	Apple IIGS Apple IIe
McGee at the Fun Fair	Preschool	Broderbund Educational Resources	25.95	Apple IIGS Macintosh
McGee Visits Katie's Farm	Preschool	Broderbund(see above) Educational Resources	25.95	Apple IIGS Macintosh
Monsters and Make Believe™	Preschool School-age	Pelican, a division of Queue, Inc.	49.95 35.95	Apple IIGS Apple IIe
Muppet™ Slate	Preschool	Wings for Learning/ Sunburst 1600 Green Hills Road PO Box 660002 Scotts Valley CA 95067-0002 408-438-5502 800-628-8897	75.00	Apple IIe Apple IIGS
Muppet™ Word Book	Preschool	Wings for Learning (see above)	65.00	Apple IIe Apple IIGS

Once Upon A Time..Series Vol I,II,III	Preschool School-age	Compu-Teach™ PO Box 9515 New Haven CT 06534 800-44-TEACH 203-777-7738	49.95 VI 25.95 VII VIII 31.95	Apple IIGS Apple IIe
Paint with Words	Preschool	MECC (see above)	29.95	Apple IIe Apple IIGS
Pow! Zap! Kerplunk!	Preschool	Pelican (see above)	49.95 35.95	Apple IIGS Apple IIe
Print Shop Deluxe	all ages	Broderbund	49.00	Mac
Read Along Series	Preschool	Berta-Max, Inc. 2901 T Avenue Unit 2 Ana___tes WA 98221 206 293-1978	79.90	Apple IIe Apple IIGS
Reader Rabbit 2	preschool school age	The Learning Company	35.00	Mac
Reading Magic Library Flodd, the Bad Guy	Preschool School-age?	Tom Snyder (see above)	44.95 31.95	Apple IIe Apple IIGS
Reading Magic Library Jack and the Bean Stalk	Preschool School-age?	Tom Snyder Productions 90 Sherman Street Cambridge MA 02140 800-342-0236 617-876-4433	44.95 31.95	Apple IIe Apple IIGS
Robot Writer™	Preschool	Pelican (see above)	49.95 35.95	Apple IIGS Apple IIe
Speaking Dynamically	Preschool School-age	Mayer-Johnson Co. (see above)	299.00	Macintosh
Storytime Tales	Preschool	Don Johnston Development Equipment, Inc. (see above)	95.00	Macintosh

The Backyard	ages 3-6	Broderbund	30.00	Mac IBM/Tandy Windows
The Children's Writing & Publishing Center	Preschool School-age	The Learning Company 6493 Kaiser Drive Fremont CA 94555 800 852-2255 415 792-2101	56.95	Apple IIe Apple IIGS Macintosh?
The Manhole	all ages	Cyan, Inc. P.O. Box 28096 Spokane, WA 99228 509-468-0807	29.95	Mac
The Playroom™	Preschool	Broderbund Software PO Box 12947 San Rafael; CA 94913-2977 800-521-6263	49.95 33.95	Apple IIGS Apple IIe IBM
The Print Shop®	Preschool School-age	Broderbund	59.95	Macintosh Apple IIGS IBM
The Treehouse	Preschool	Broderbund	44.95	Macintosh IBM
The Whole Neighborhood™	Preschool	Pelican (see above)	49.95	Apple IIGS Apple IIe
Thinkin Things	preschool school age	Edmark	39.95	Mac IBM

Word Tales	age 4-7	Time Warner Interactive Group 2210 Olive Ave. Burbank, CA 9150 email: dukeofrom@aol.com. 800-593-6334	39.00	Mac MPC (IBM)
ZoomBooks Four Footed Friends	Ages 3 and up	T/Maker Company 1390 Villa Street Mountain View, CA 94041 tel: 415-962-0195 FAX: 415-962-0201	35.00	Mac Windows (IBM compatible)

Courseware Definition Form

Course Title:

Course Rationale:

Learner Description:

Anticipated Audience:

Approximate Age Range:

Approximate Grade/Reading Level:

Other significant learner characteristics:

Prerequisite skills for learners:

What the course prepares the learner to do:

Lesson Environment:

Describe setting(s) in which the course will be used:

Is supervision needed to start the course?

Is supervision needed to answer questions?

Would music/sound distract others?

Learner interaction required:

What instructional medium or system is recommended for the presentation?

Why?

Course Behavioral Objectives:

1. Upon completion of the individual units in the ---, students will demonstrate mastery of ---, based upon the observations of the teacher.

2.

3.

Steelman, J. D., Barton, D. (1989). Courseware definition form. Developed as technical consultants for instructional design of software.

General Course Presentation (Flow):

Approximate time involved in the course: hours

Approximate time involved in each unit: minutes

Approximate time involved in each lesson: minutes

Instructional Approaches:

Lesson Design (see attachments for a detailed descriptions)

Functional Designs

___ 1. Drill & Practice
___ 2. Tutorial
___ 3. Instructional Games
___ 4. Problem-Solving
___ 5. Simulations
___ 6. Combination of the above designs

Physical Designs

___ 1. Linear
___ 2. Spiral
___ 3. Branching
___ 4. Multitrack
___ 5. Regenerative
___ 6. Adaptive

Logical Designs

___ 1. Didactic
___ 2. Discovery
___ 3. EGRUL
___ 4. RULEG
___ 5. Fading (prompts)

Record Keeping:

Pretest: Correct/incorrect responses

Post test: Correct/incorrect responses, mastery/nonmastery, percentage of correct response (ratio of number of correct responses to number of attempts)

Units: Which units completed or partially completed

Steelman, J. D., Barton, D. (1989). Courseware definition form. Developed as technical consultants for instructional design of software.

Unit Development Form

Unit Title:

Scope of the Unit:

Unit Rationale:

Behavioral Objectives:

Criterion Frames (questions assessing attainment of behavioral objectives):